DARPA Subterranean (SubT) Challenge

Dr. Timothy Chung
Tactical Technology Office

Proposers Day

January 18th, 2018

Welcome to the DARPA Subterranean Challenge Proposers Day

The goals of the Proposers Day are:

- To **introduce** the DARPA Subterranean Challenge program vision and goals to the broader community
- To **facilitate** interaction between researchers, developers, and stakeholders with capabilities and interests relevant to the DARPA Subterranean Challenge
- To **promote** the formation of cross-cutting teams responsive to the DARPA Subterranean Challenge program vision

Proposers Day Agenda

January 18, 2018

8:15 am - 9:00 am	*Registration*
9:00 am - 9:15 am	**Welcome and Introductions** Dr. Timothy Chung, DARPA TTO
9:15 am - 9:30 am	**Security Briefing and Contract Management Office Briefing** Ms. Sonya Maldonado, DARPA SID Mr. Chris Glista, DARPA CMO
9:30 am - 9:45 am	**TTO Overview** Dr. Fred Kennedy, DARPA TTO
9:45 am - 10:15 am	**DARPA Subterranean Challenge Vision and BAA Overview** Dr. Timothy Chung, DARPA TTO
10:15 am - 10:30 am	*Break*
10:30 am - 11:15 am	**Attendee Lightning Presentations Part I**
11:15 am - 12:30 pm	**Open Poster Session 1**
12:30 pm - 1:30 pm	*Lunch (on your own)*
1:30 pm - 2:00 pm	**Q&A Session - Answers to Submitted Questions**
2:00 pm - 2:45 pm	**Attendee Lightning Presentations Part II**
2:45 pm - 4:00 pm	**Open Poster Session II**
4:00 pm - 4:15 pm	**Closing Remarks** Dr. Timothy Chung, DARPA TTO

Lightning Talks and Interactive Poster Sessions

The purpose is to **inspire information exchange** and **facilitate potential teaming**

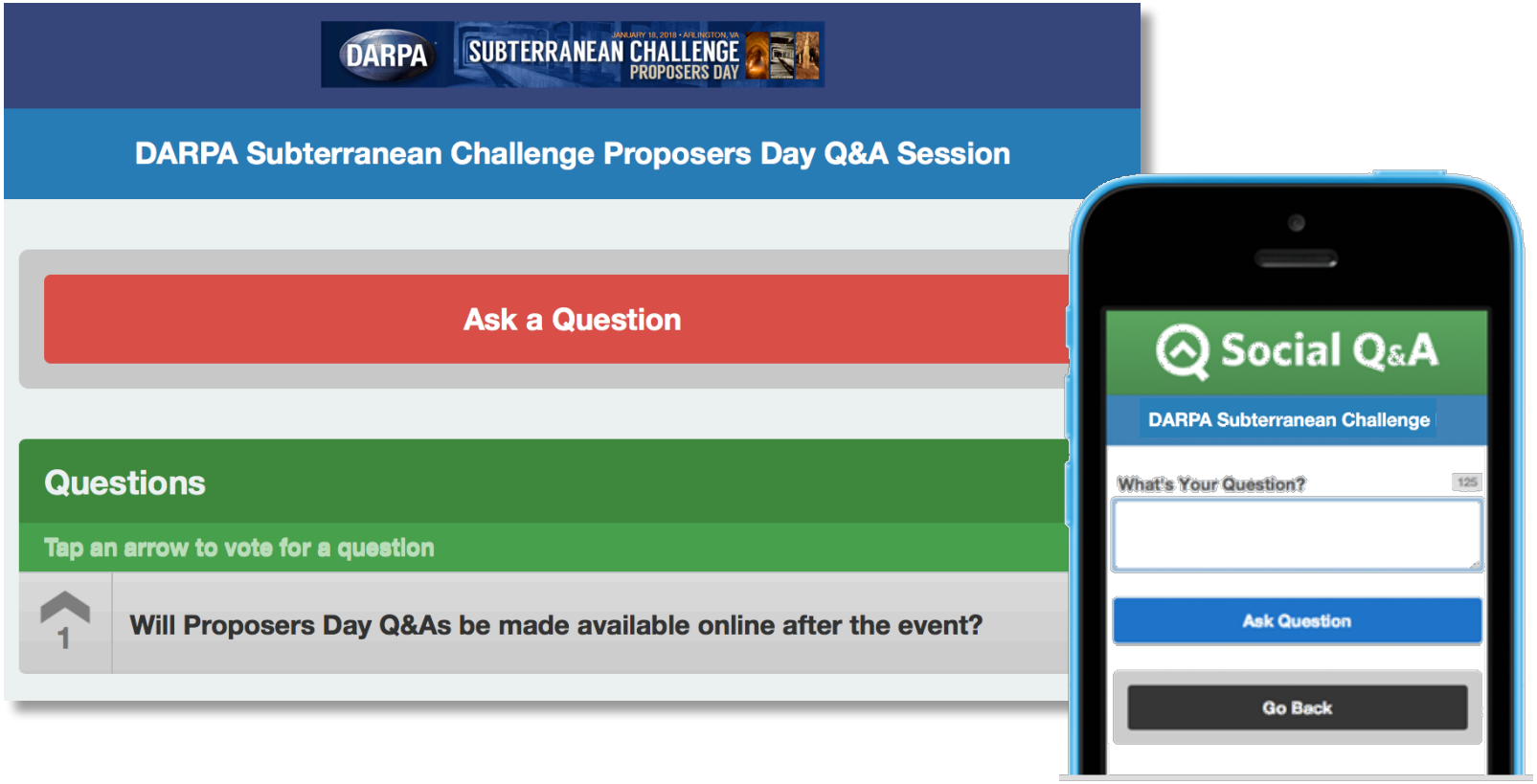
Presenters Rules of Engagement

- Lighting Talks
  - Receive your presenter number and time slot at registration
  - Take your assigned (numbered) seats up front before your session
  - Stay within your **two minutes** (you will be buzzed!)

- Poster Session
  - Find your assigned easel in poster area
  - Set up your poster before your session
  - Meet, share with, and learn from fellow attendees

Questions and Answers

DARPASubTChallenge.socialqa.com



- View, vote, and ask questions
- Questions are moderated
- FAQs to be posted on FedBizOpps.gov

DARPA Subterranean (SubT) Challenge

Dr. Timothy Chung
Tactical Technology Office

Program Overview

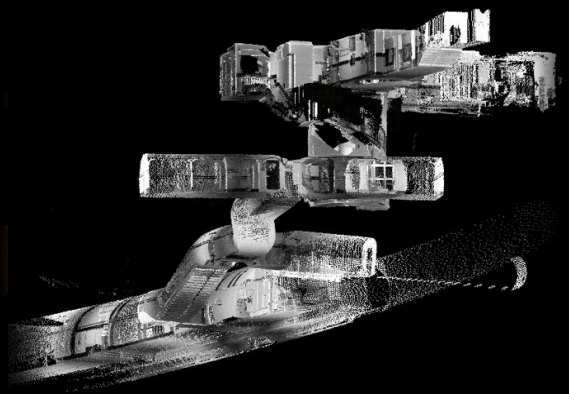
January 18th, 2018

Unearthing the Subterranean Environment: The Hidden Domain

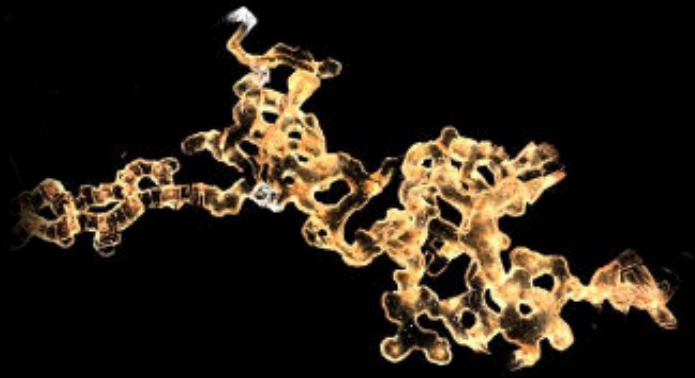
Current technologies fail to provide
rapid mapping and persistent situational awareness
of the diverse subterranean operating environment

Border Tunnels

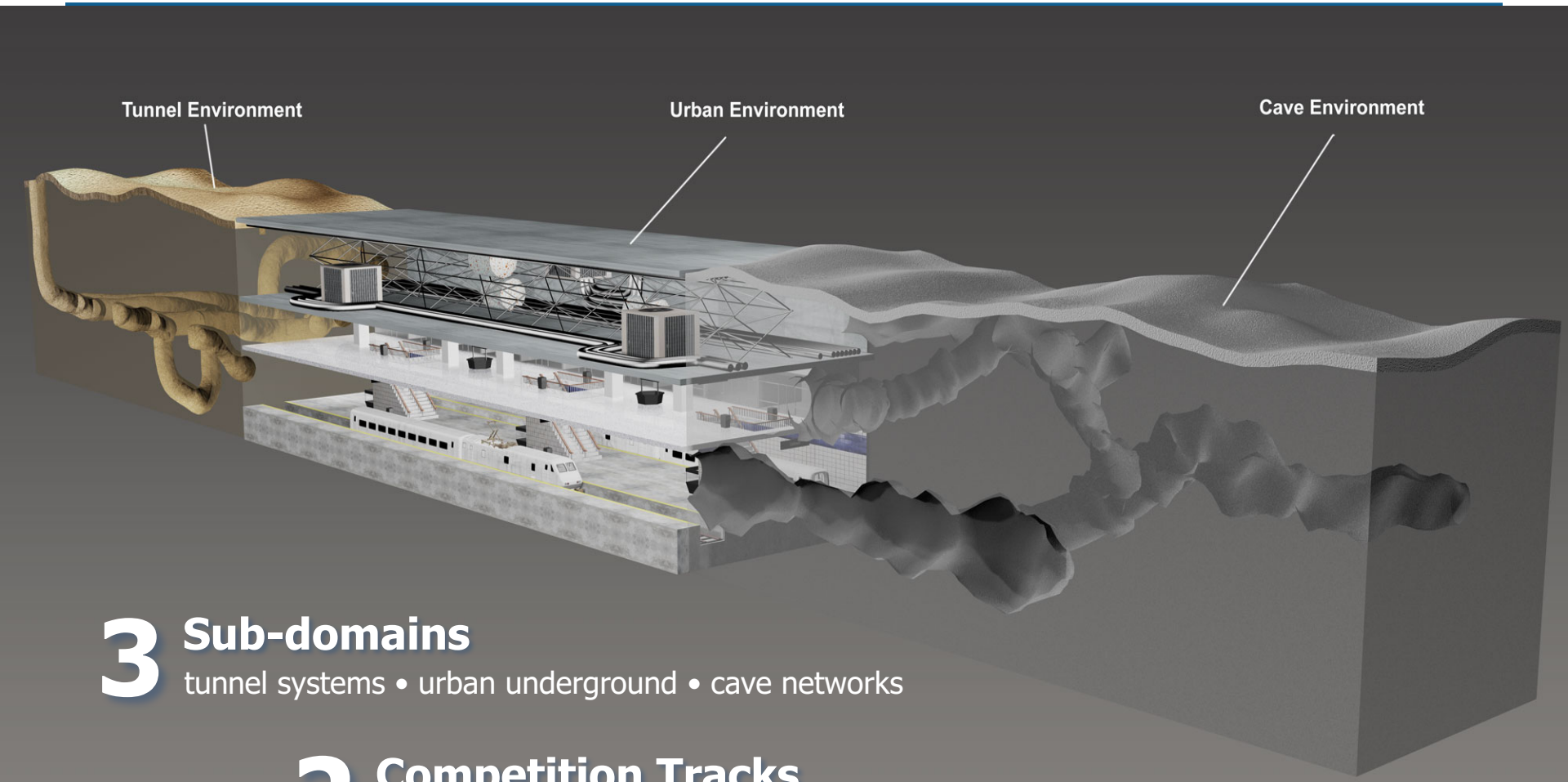
Urban Underground



Cave Networks



Introducing the **DARPA Subterranean Challenge**



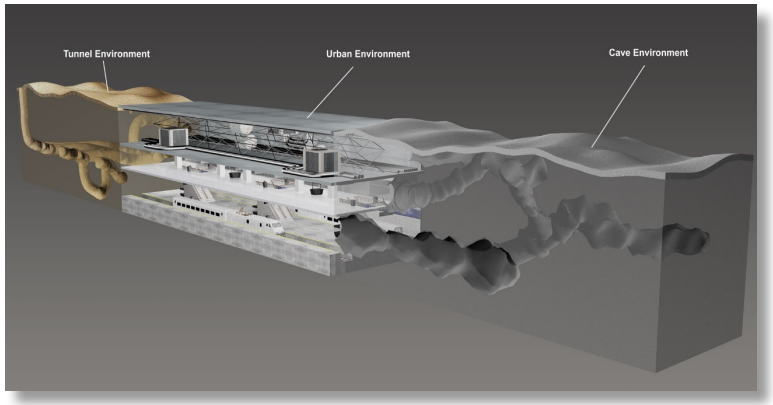
3 Sub-domains
tunnel systems • urban underground • cave networks

2 Competition Tracks
Systems Track • Virtual Track

1 Challenge Vision
Revolutionize how we operate in the underground domain

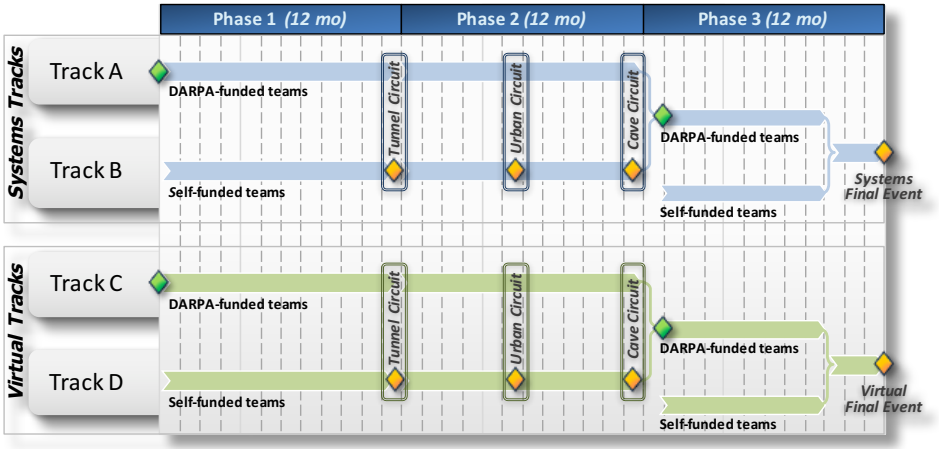
DARPA Subterranean Challenge: Technical and Program Description

Why



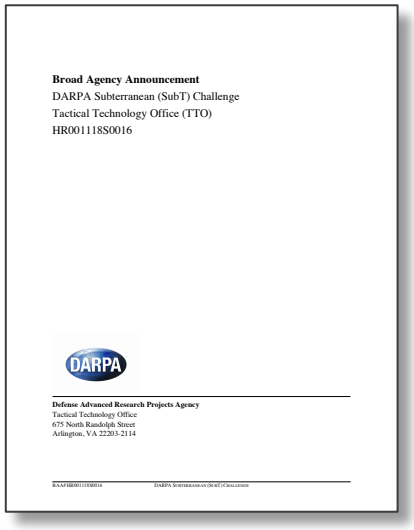
What

When **Where**



Who

How



Broad Agency Announcement
DARPA Subterranean (SubT) Challenge
Tactical Technology Office (TTO)
HR001118S0016

DARPA

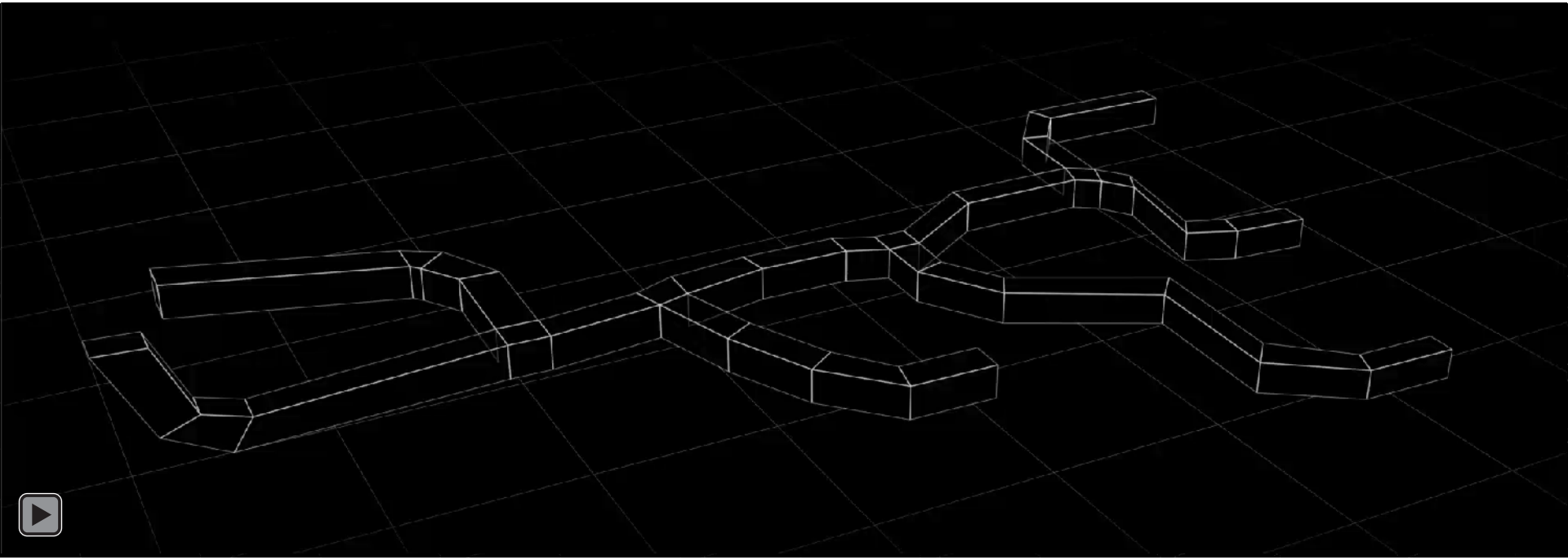
Defense Advanced Research Projects Agency
Tactical Technology Office
675 North Randolph Street
Arlington, VA 22203-2114

Illustrative Scenario of Interest

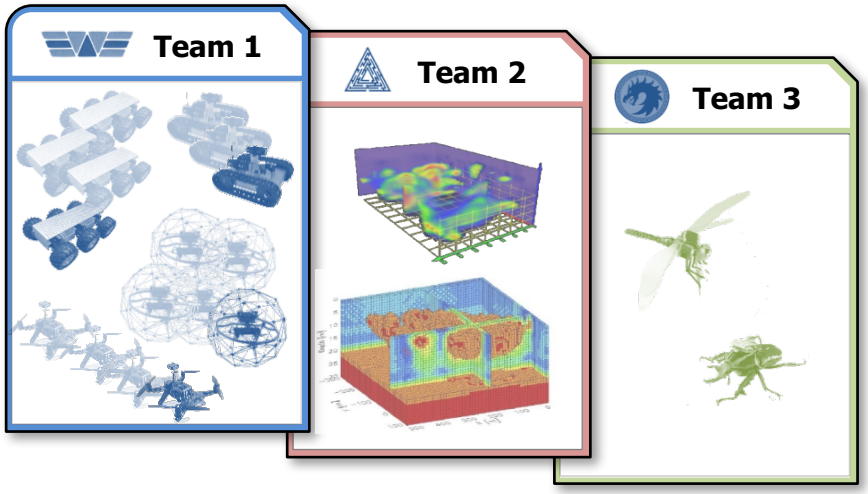
*Need for **rapid situational awareness** for warfighters or first responders operating in **unknown and dynamic environments**. The layout of the environment is **unknown**, could **degrade** or **change** over time, and is **too high-risk** to send in personnel*

Lead Time:	T minus "weeks"	T minus "hours"	T minus "minutes"
OPTEMPO:	Slow, Deliberate	Urgent	Real-time
Risk:	Low	(Too) high	Acceptable
Mission:	Discovery, Inspection	Search & Rescue	Intervention

Envisioned Gameplay for the DARPA Subterranean Challenge



1. **Initialize challenge course**
2. **Deploy competitor solution**
3. **Commence competition run**
4. **Declare winning team**



Challenge Elements to Inspire Technology Breakthroughs

Austere navigation
GPS-less and sparsely featured surroundings

Degraded sensing
Low-light, obscured, and scattering conditions

Severe comms
Physical impediments to reliable links

Dynamic terrain
Physical changes to the environment

Endurance limits
Operationally relevant spatial scales

Terrain obstacles
Mobility-stressing terrain features

Technology Impact

Autonomy | **Perception** | **Networking** | **Mobility**

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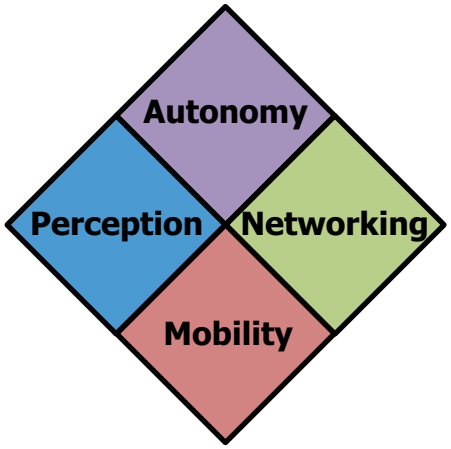
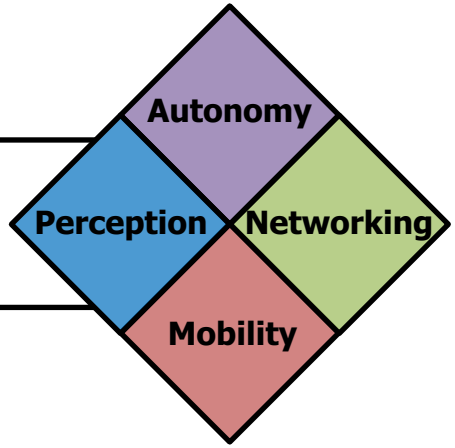


	Autonomy	Perception	Networking	Mobility
1. Austere Navigation	✓	✓	✓	
2. Degraded Sensing		✓	✓	✓
3. Severe Comms	✓		✓	
4. Terrain Obstacles	✓	✓		✓
5. Dynamic Terrain	✓	✓		✓
6. Endurance Limits			✓	✓

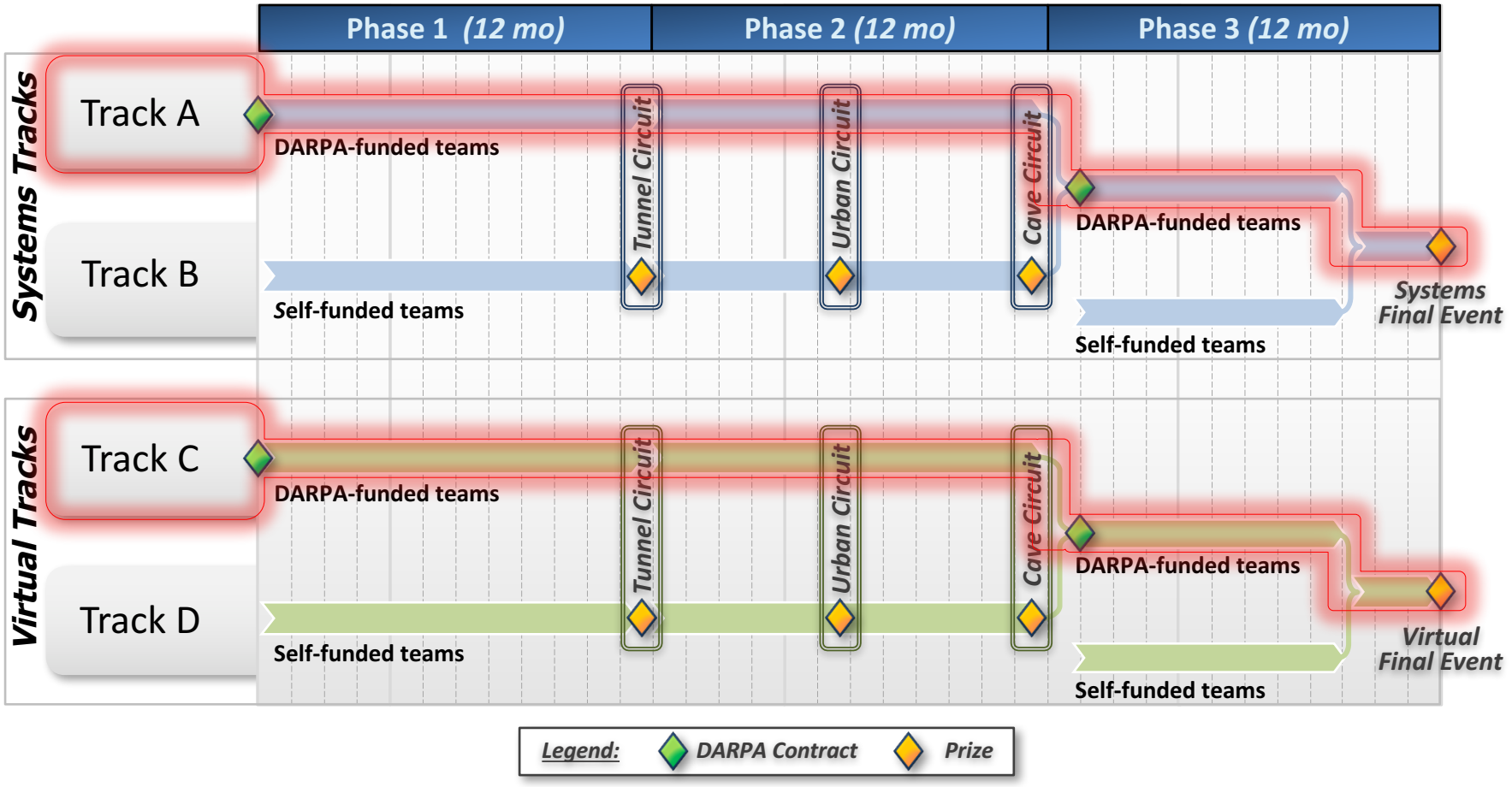
DARPA Subterranean Challenge Technology Areas

Challenge Focus: Drive innovation and investment to accelerate breakthroughs for exploring complex unstructured environments



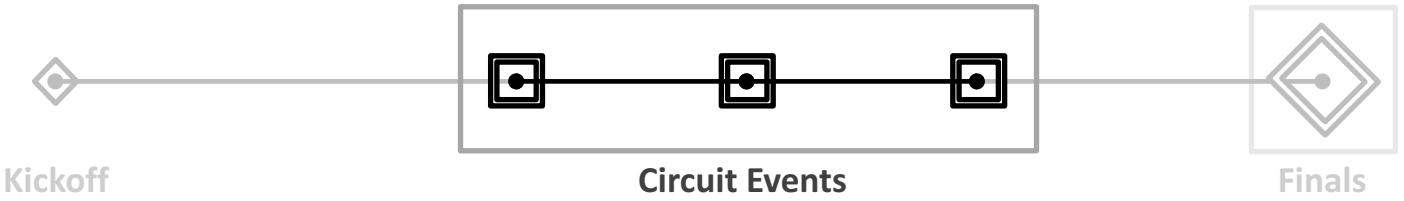
Technology Area	Relevant Metrics	Stretch Goals
Autonomy	Number of manual interventions during mission	Zero interventions over four-hour mission
Perception	Resolution of multimodal 3D mapping	<10cm map detail
	Geo-localization of physical agents over mission duration	<1m error over 1km traversed
Networking	Latency in situational awareness updates per traversal distance	<1s per 500m path length
Mobility	Effective, team-aggregated mission endurance	Four-hour effective endurance

Challenge Schedule and Tracks



Focus of the DARPA SubT Challenge BAA

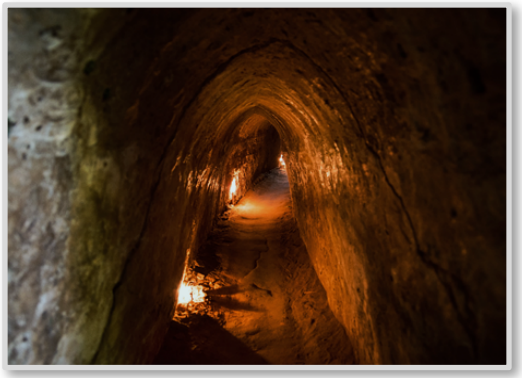
Challenge Circuits: Advancing Technologies through Cross-Training



Circuits offer focused challenge events to:

- Promote **frequent "build-test-compete"** iterations within and among teams
- Directly **involve operational needs** in design of circuit courses
- Explore both **illustrative and operational scales** via Systems and Virtual tracks

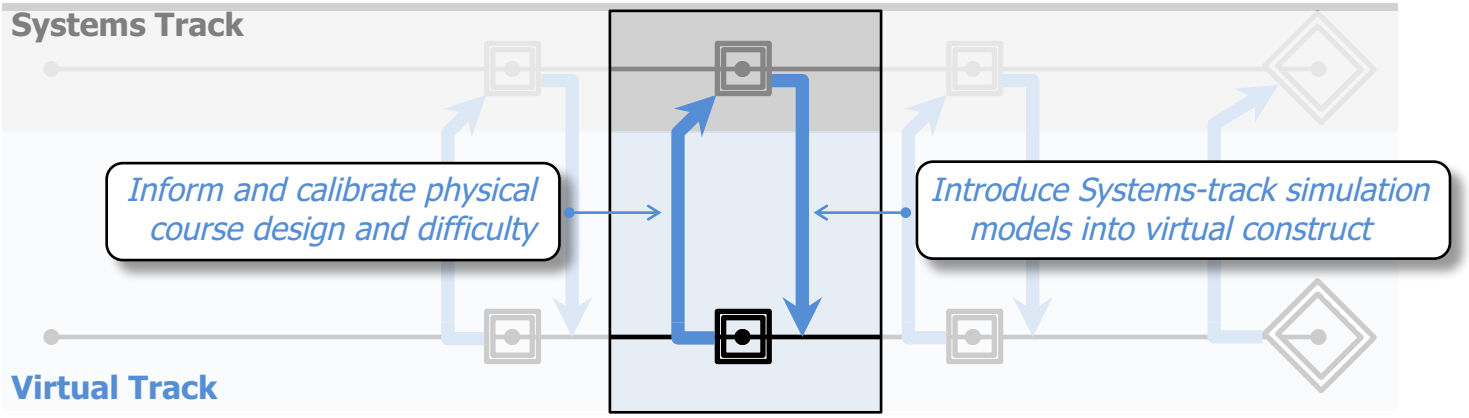
Tunnel Circuit



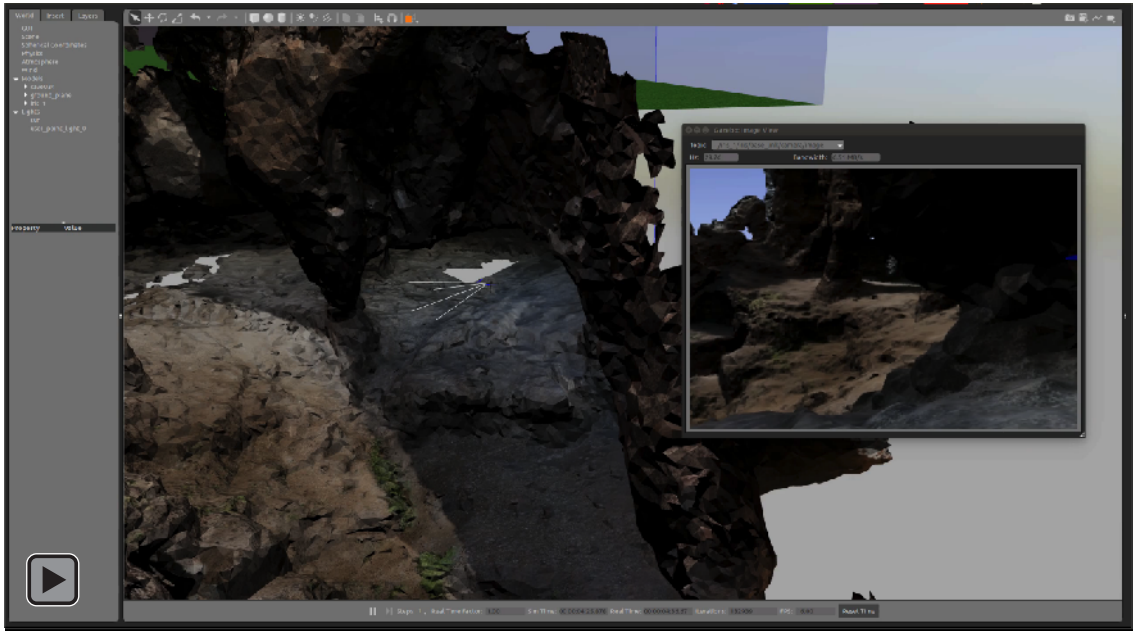
Urban Circuit

Cave Circuit

Virtual Competition: Jumpstarting Insights for Future Capabilities



Physics-based simulator
camera-mounted quadrotor in a rendered cave



What DARPA is looking for?

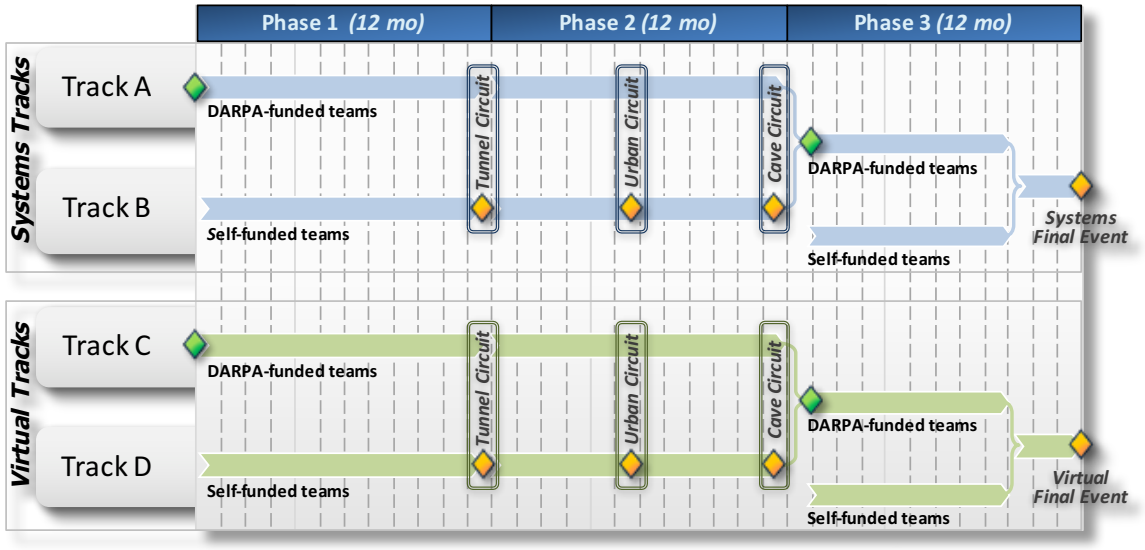
- Read the (draft) BAA!
  - Revolutionary and innovative technical approaches
  - Strong, integrated, agile, holistic teams

- Competition Tracks
  - Systems
  - Virtual

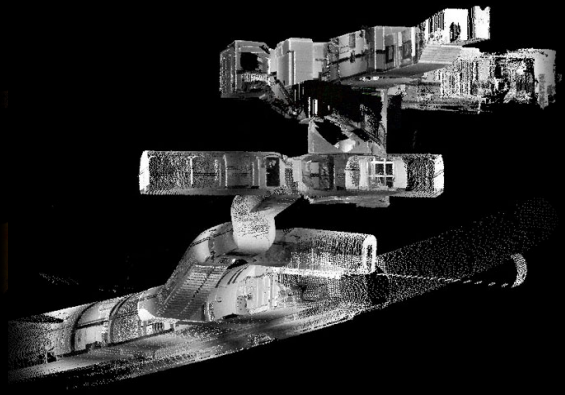
- Phases
  - Phase 1 (base)
  - Phase 2 (option)
  - Phase 3 (option)

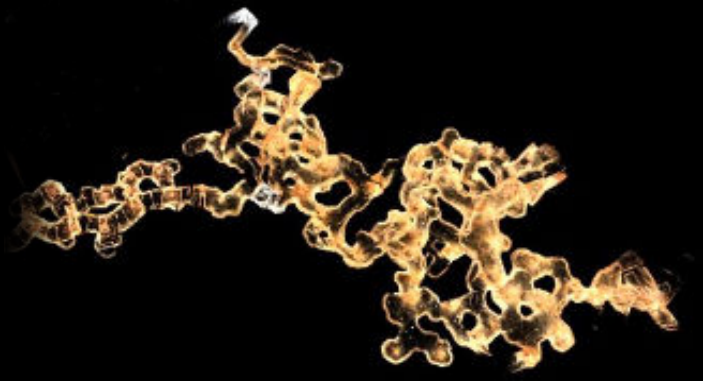
- FAQs

- Contracting



Good luck!





DARPA

The relationship between warfare and terrain demands "the faculty of quickly and accurately grasping the topography of any area."

- Clausewitz, *On War*